Customizing Mac OS X Using Open Source

Session 508

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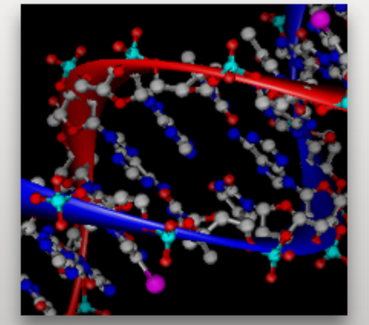

OS Foundations

Customizing Mac OS X Using Open Source

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http://developer.apple.com/wwdc2005/

Overview

- What is open source?
- What is Darwin?
- Adding new software
- Customizing Mac OS X
- Our “hands-on” example
  - Use sample code downloaded from WWDC site

What Is Open Source?

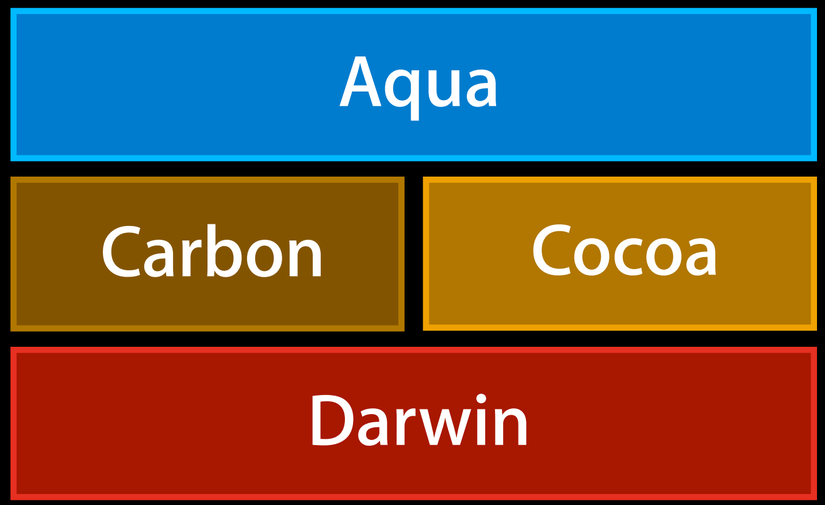
Published source code you are allowed to modify

- Many open source projects on the internet
- Much of Mac OS X is open source
- More info at Open Source Initiative (OSI)
  http://www.opensource.org/

What Is Darwin?

Open source core of Mac OS X

- Kernel
- IOKit drivers and families
- BSD commands and libraries



How Does It Help?

Darwin provides…

- Reference
- Debugging
- **Customization**
  - Security Updates
  - Interoperability
- Research

Hands-on

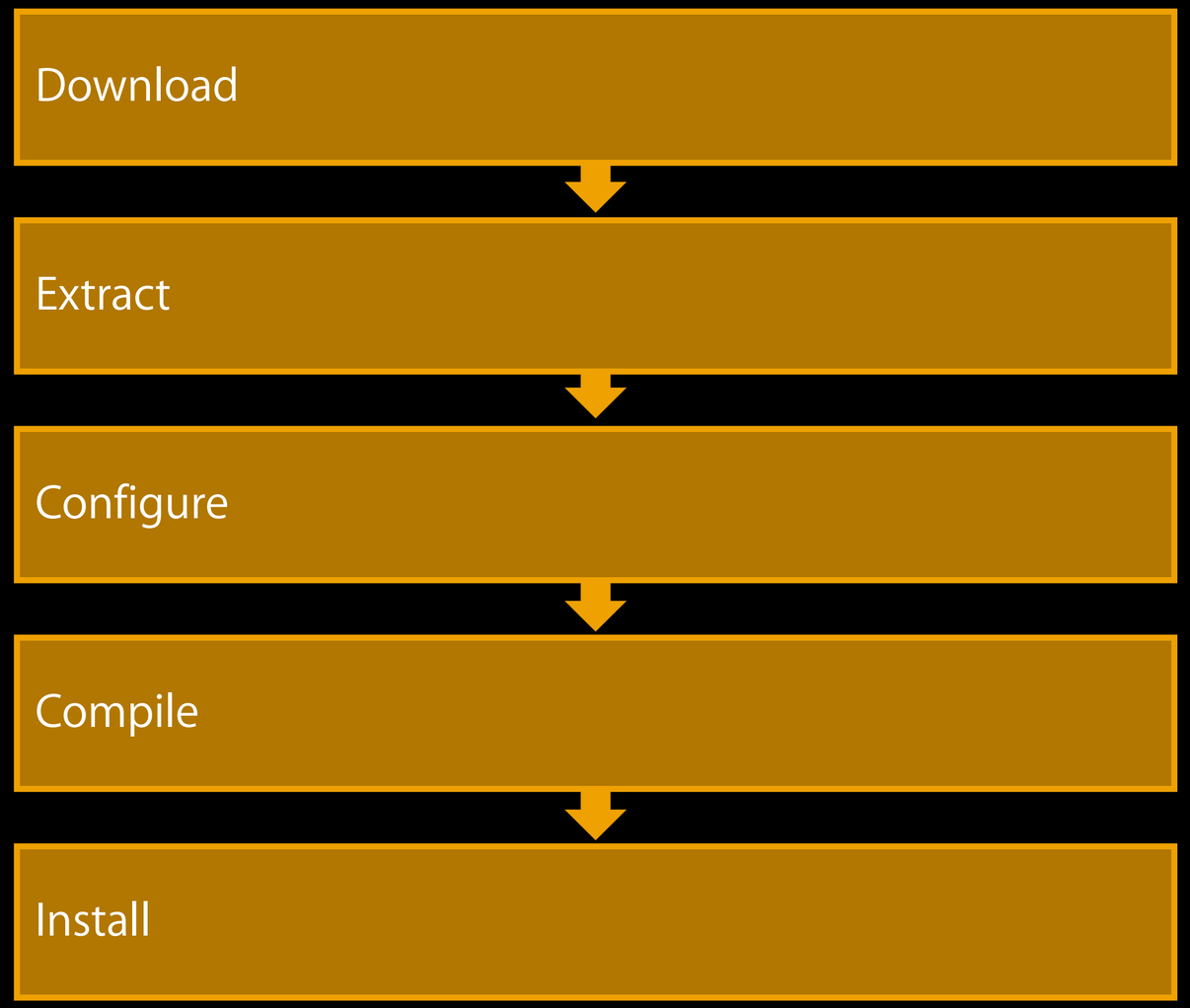
Add Bonjour support to the BSD UNIX talk utility

- DarwinBuild
  http://darwinsource.opendarwin.org/darwinbuild/

Adding New Software

http://developer.apple.com/wwdc2005/

Basic Open Source “Lifecycle”



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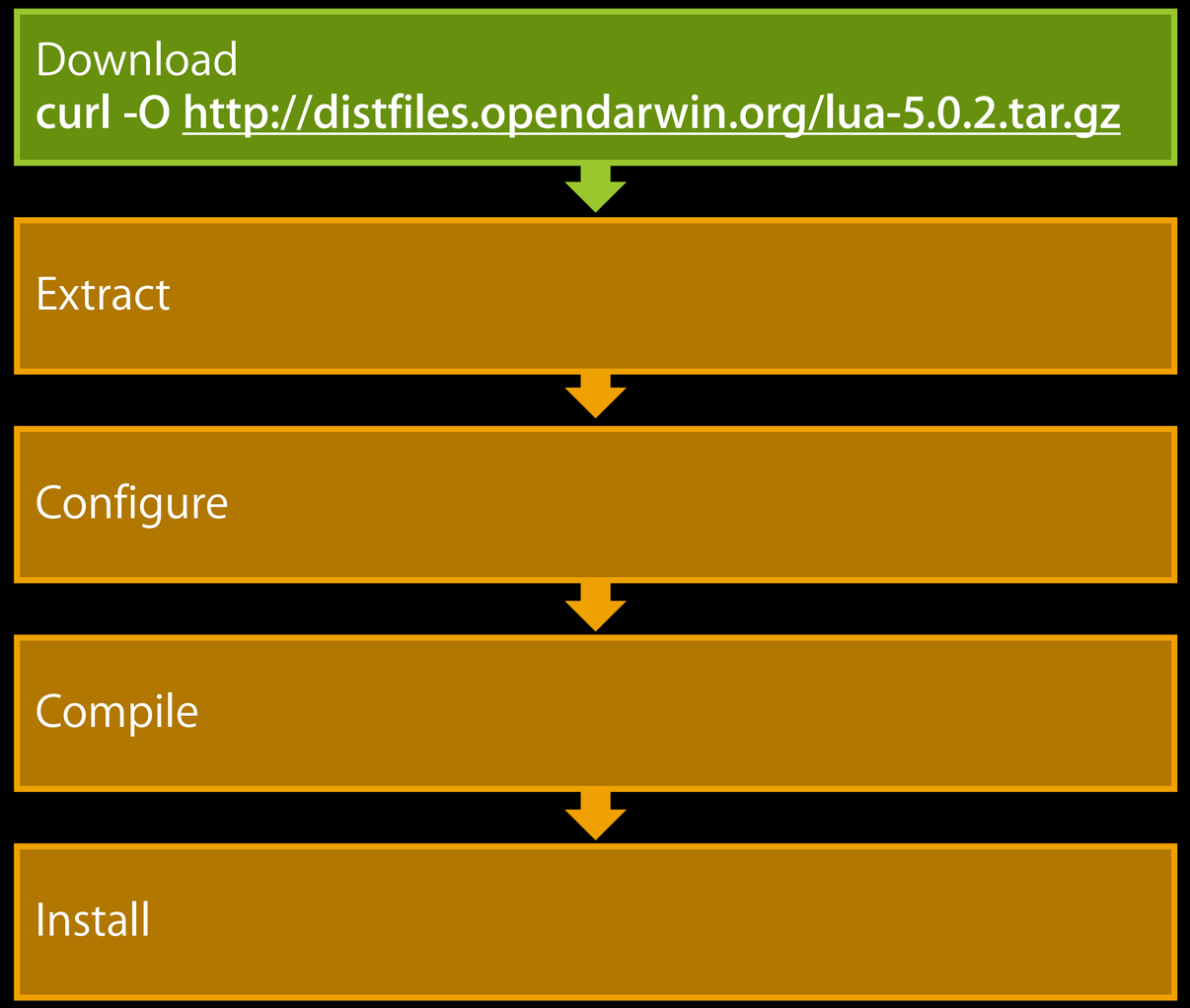

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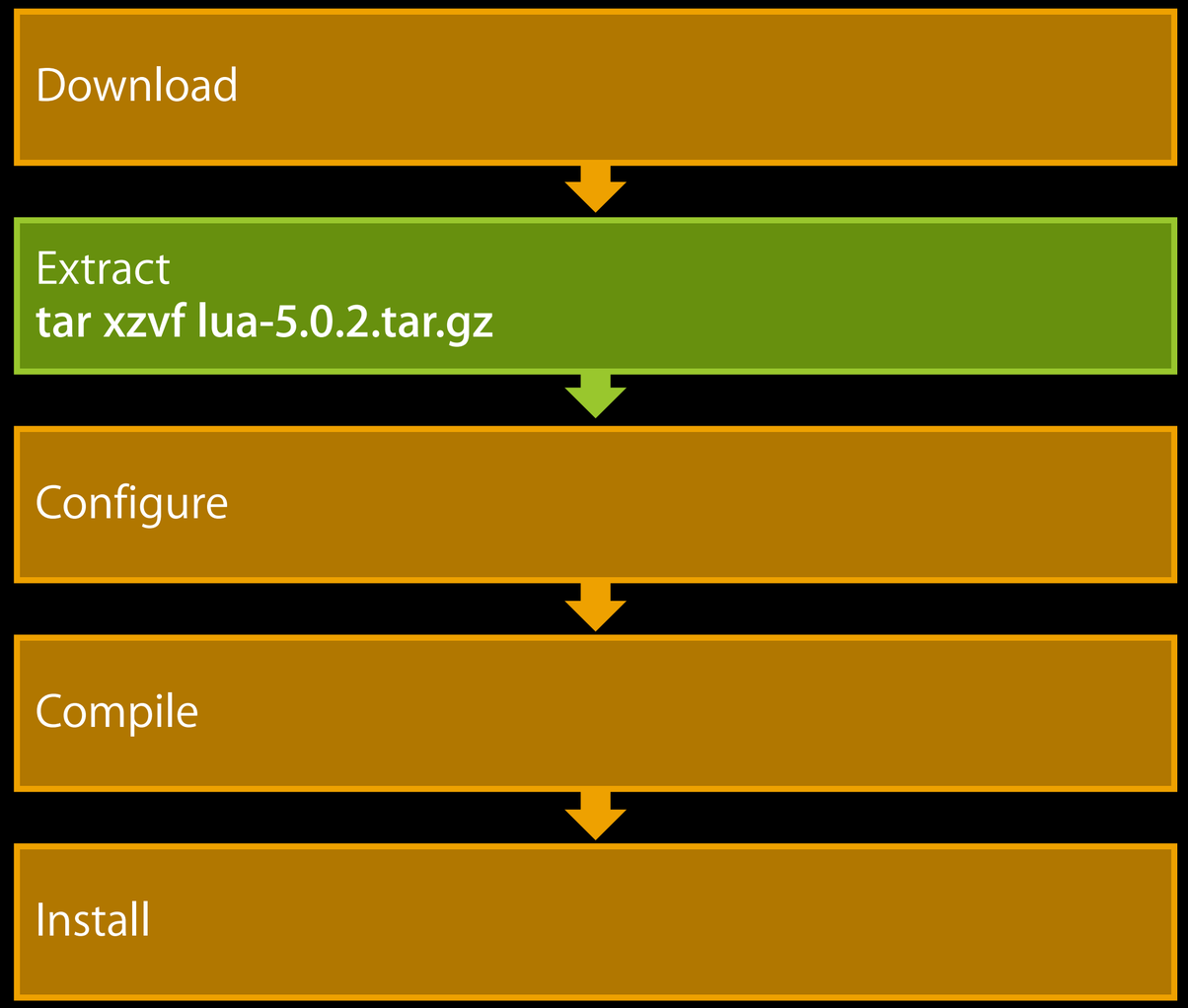

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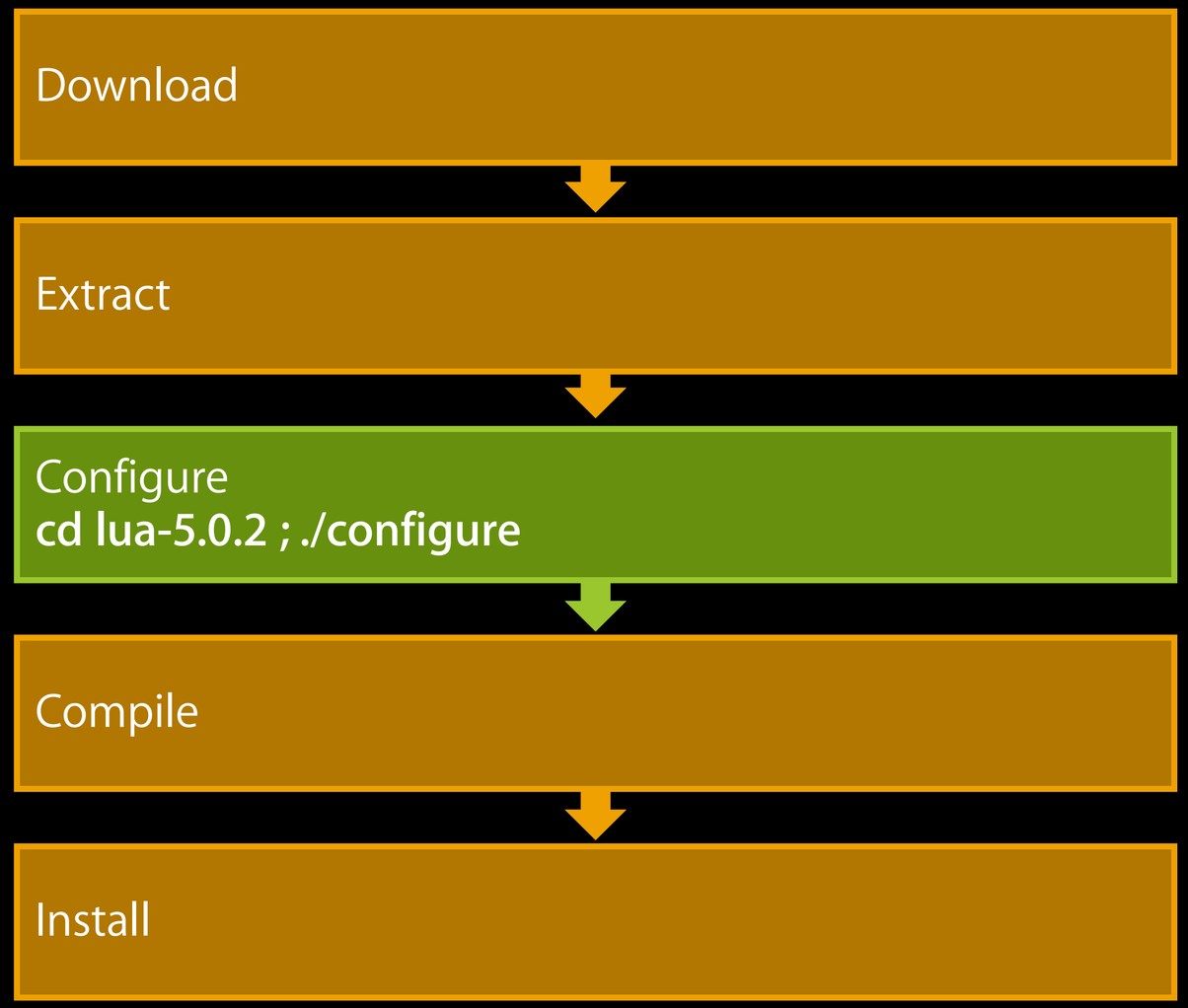

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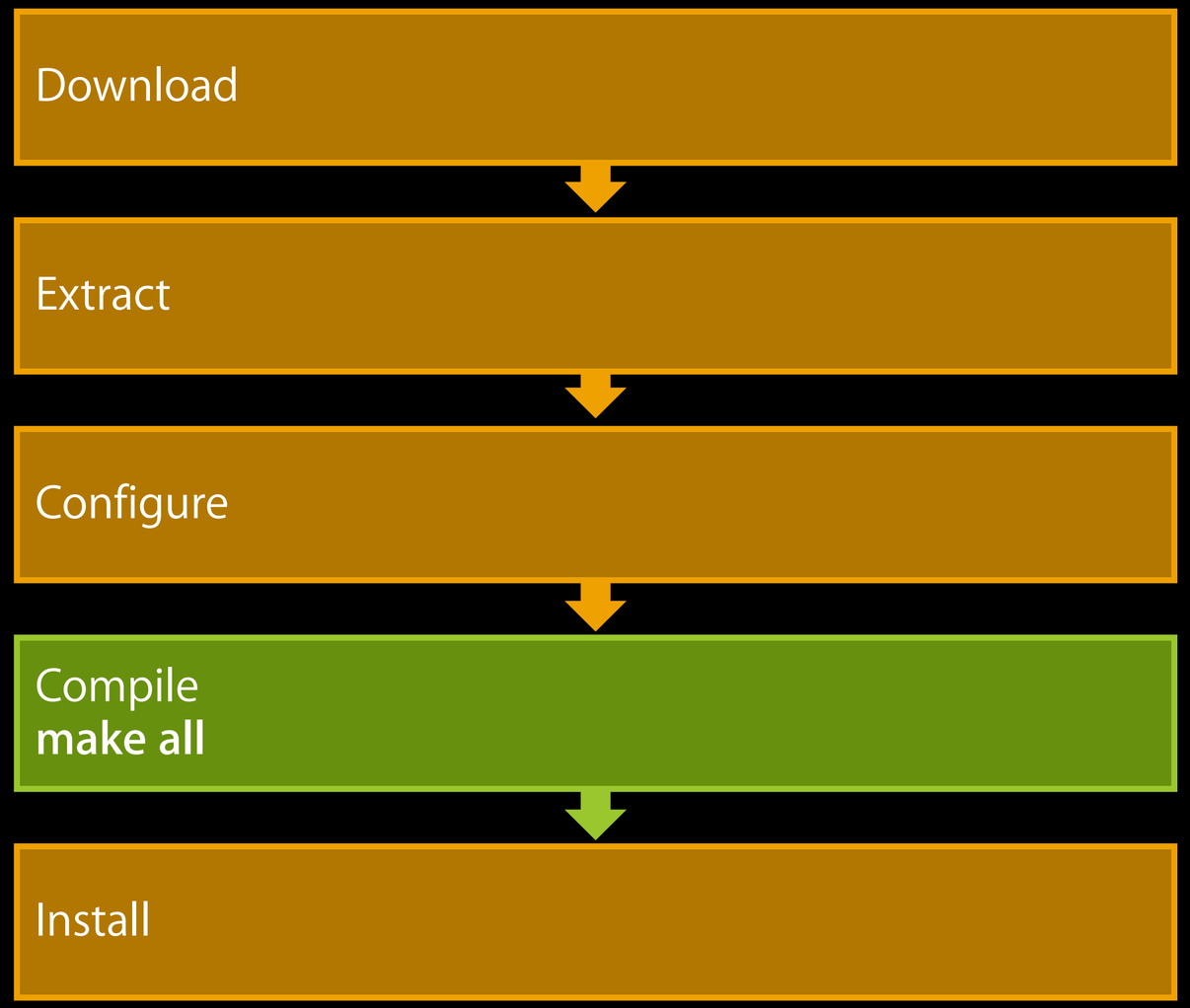

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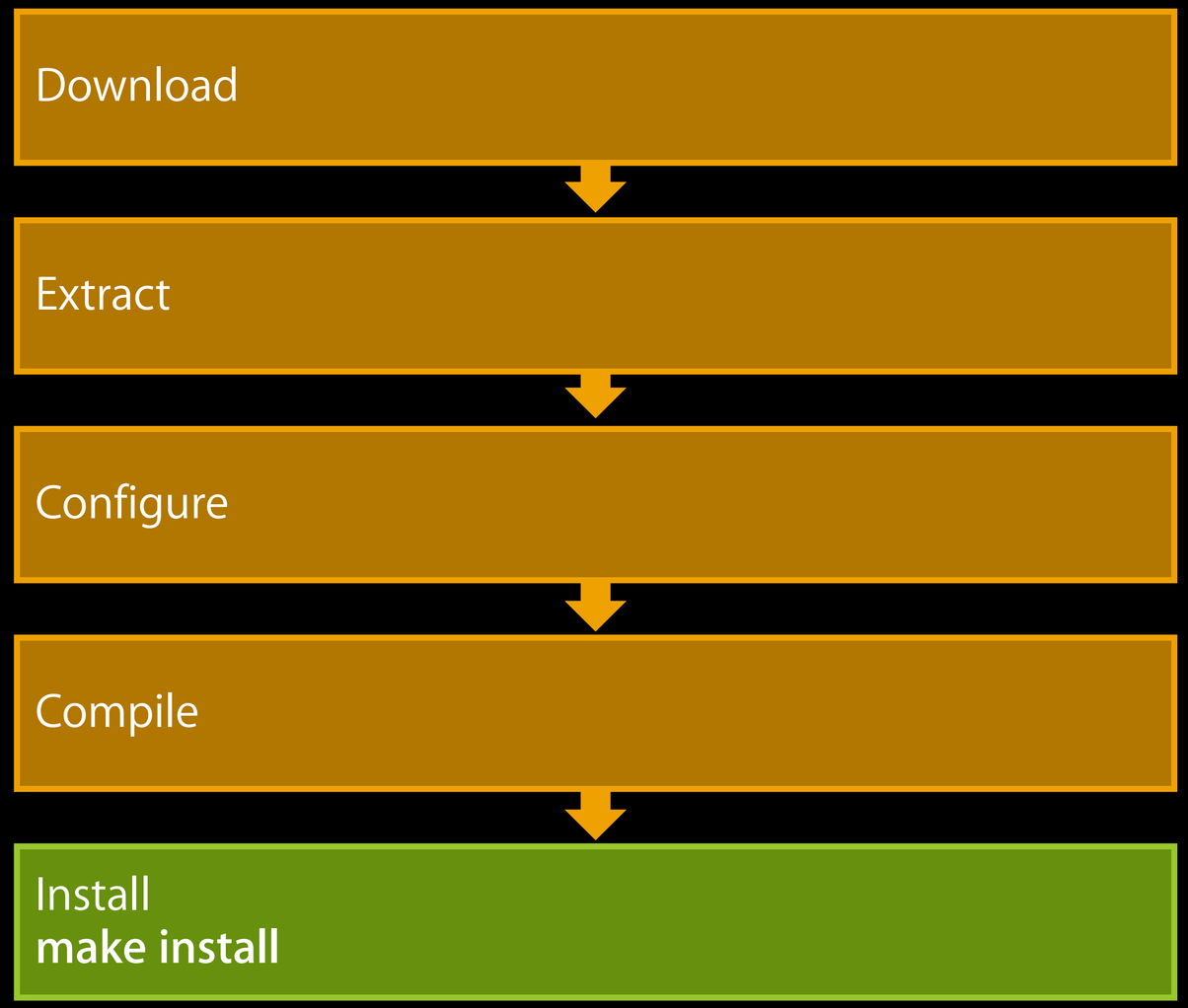


Fink

http://fink.sourceforge.net/

- Based on Debian packages (dpkg)
- Over 5,000 programs
- Offers pre-built software for faster installation

DarwinPorts

http://darwinports.opendarwin.org/

- Similar to FreeBSD Ports
- Over 2,500 programs
- Builds from scratch, easy customization

Adding New Software

- Avoid system directories
  - /System
  - /usr
- /usr/local
  - Apple does not install here, but used internally for Darwin
- DarwinPorts
  - /opt/local
- Fink
  - /sw

Configuring, Building, and Installing

1. Configure with an appropriate directory prefix

```
./configure --prefix=/my_stuff
```

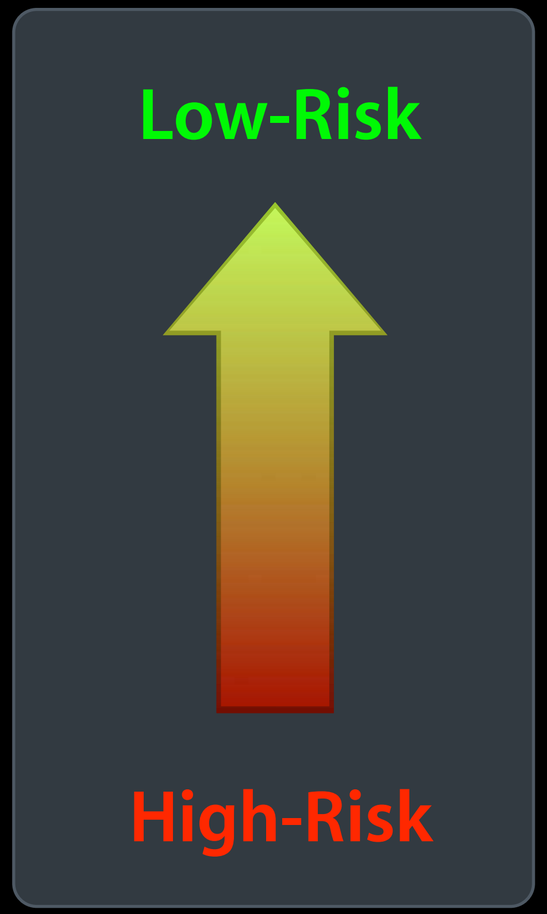
2. Install into an intermediate directory

```
make install DESTDIR=/tmp/new_project
```

3. Inspect build result before copying to system

Customizing Mac OS X

http://developer.apple.com/wwdc2005/



Command-line tools

Plugins

Libraries / Frameworks

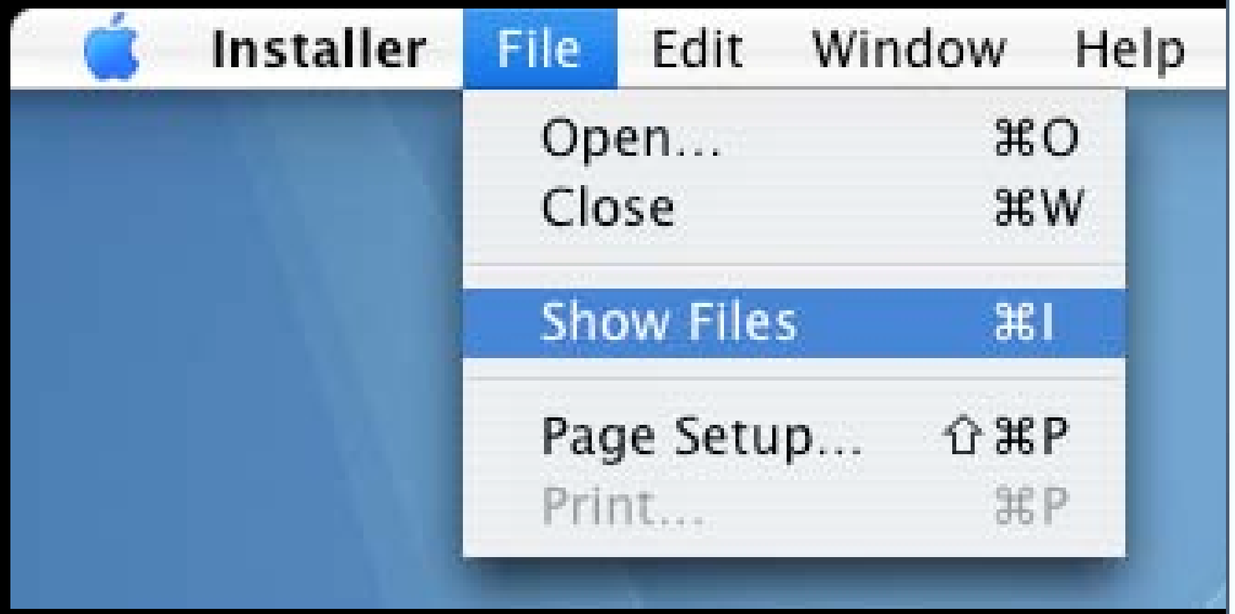
Kernel / Kernel Extensions

Software Update

- May overwrite your modifications
- Library / Framework upgrades may be incompatible
- **Download packages and install manually**
- **http://www.apple.com/support/**

Software Update

Show files before installing



```
$ lsbom MacOSXUpdate10.4.1.pkg/Contents/Archive.bom
```

Minimize the Risk

- Download sources from Apple
  - http://www.opensource.apple.com/darwinsource/
  - http://darwinsource.opendarwin.org/

- Change as little as possible

Build Environment

Many, many little details

- System and kernel version?
- Developer Tools version?
- Environment variables?
- Headers and libraries?

System and kernel Version

- sw_vers

```
$ sw_vers
ProductName:    Mac OS X
ProductVersion: 10.4
BuildVersion:   8A428
```

- uname -a

```
$ uname -a
Darwin turing.apple.com 8.0.0 Darwin Kernel Version 8.0.0: Sat Mar
26 14:15:22 PST 2005; root:xnu-792.obj~1/RELEASE_PPC Power
Macintosh powerpc
```

Developer Tools

Know which compiler you're using

- gcc 2.95.2
- gcc 3.1
- gcc 3.3
- gcc 3.5
- gcc 4.0

```
$ gcc -v
Reading specs from /usr/lib/gcc/powerpc-apple-darwin8/4.0.0/specs
Thread model: posix
gcc version 4.0.0 20041026 (Apple Computer, Inc. build 4061
```

Developer Tools

Choose the correct compiler

- gcc_select

```
$ sudo gcc_select 3.3
Default compiler has been set to:
gcc version 3.3 20030304 (Apple Computer, Inc. build 1809)
```

Environment Variables

The basics

SRCROOT	Where the sources are
OBJROOT	Where to put intermediate (.o) files
SYMROOT	Where to put symbolled (debug) binaries
DSTROOT	Where to finished products go

Environment Variables

Commonly used

MACOSX_DEPLOYMENT_TARGET	10.4
RC_RELEASE	Tiger
UNAME_RELEASE	8.0
RC_ARCHS	ppc i386
RC_ProjectName	Name of project being built

Build Aliases

Same sources, different results

- Based on RC_ProjectName environment variable
  - DSPasswordServerPlugin
  - DSPasswordServerFramework
  - cctools
  - cctools_ofiles
  - Libc
  - Libc_debug

Environment Variables

- MACOSX_DEPLOYMENT_TARGET=10.4
- RC_ARCHS=ppc
- RC_CFLAGS=-pipe -arch ppc
- RC_JASPER=YES
- RC_NONARCH_CFLAGS=-pipe
- RC_OS=macos
- RC_RELEASE=Tiger
- RC_XBS=YES
- RC_ppc=YES
- SEPARATE_STRIP=YES
- UNAME_RELEASE=8.0
- UNAME=Darwin

Environment Variables

- `INSTALLED_PRODUCT_ASIDES=YES`
- `NEXT_ROOT=`
- `RC_ProjectName=...`
- `SRCROOT=...`
- `OBJROOT=...`
- `SYMROOT=...`
- `DSTROOT=...`

- And on, and on, and on…

Headers and Libraries

- Many “intermediate” libraries
- `libkld.a`
  - Kernel linker library produced by “cctools_ofiles”
  - Needed by the kernel “xnu”
- `streams/streams.h`
  - Private header produced by “Libstreams”
  - Needed by “cctools_ofiles”

DarwinBuild

http://darwinsource.opendarwin.org/darwinbuild/

- Specialized tool for building Darwin
- Emulates Apple's internal build environment
- Cleanly handles private headers and tools

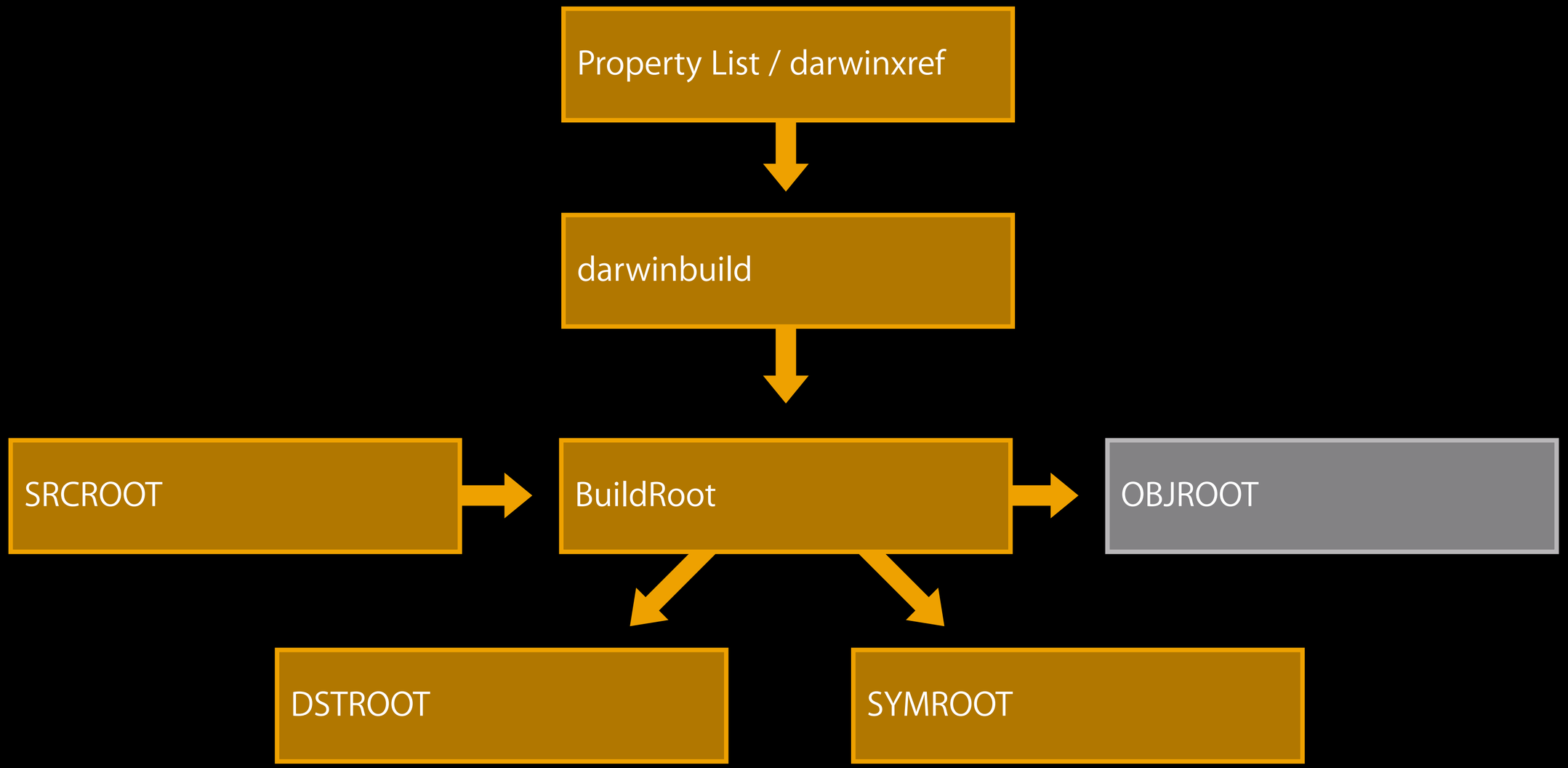
DarwinBuild Architecture

- **Property list**
  Contains all project information

- **darwinxref**
  Searches property list

- **darwinbuild**
  Builds the software

DarwinBuild Architecture



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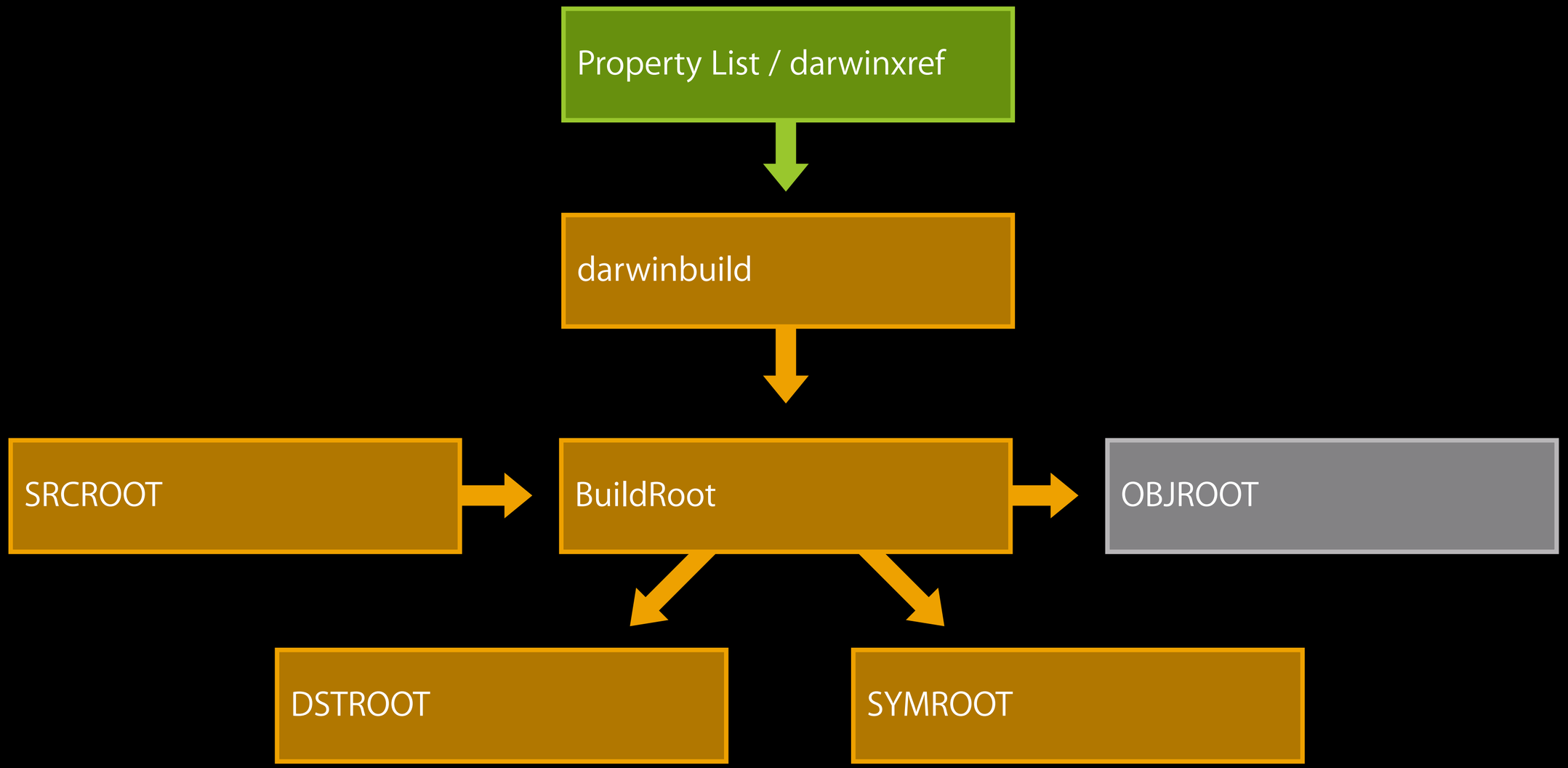

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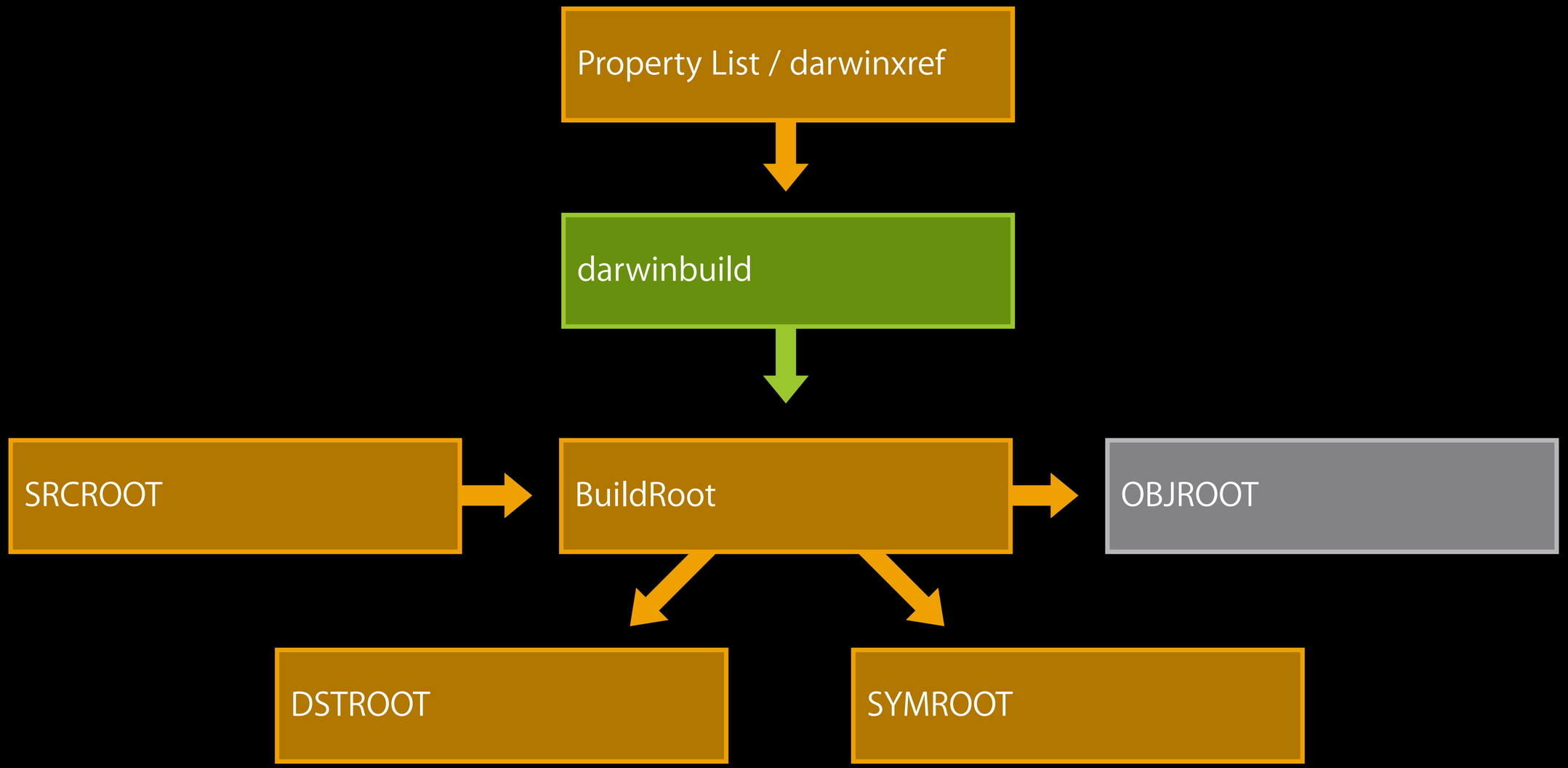

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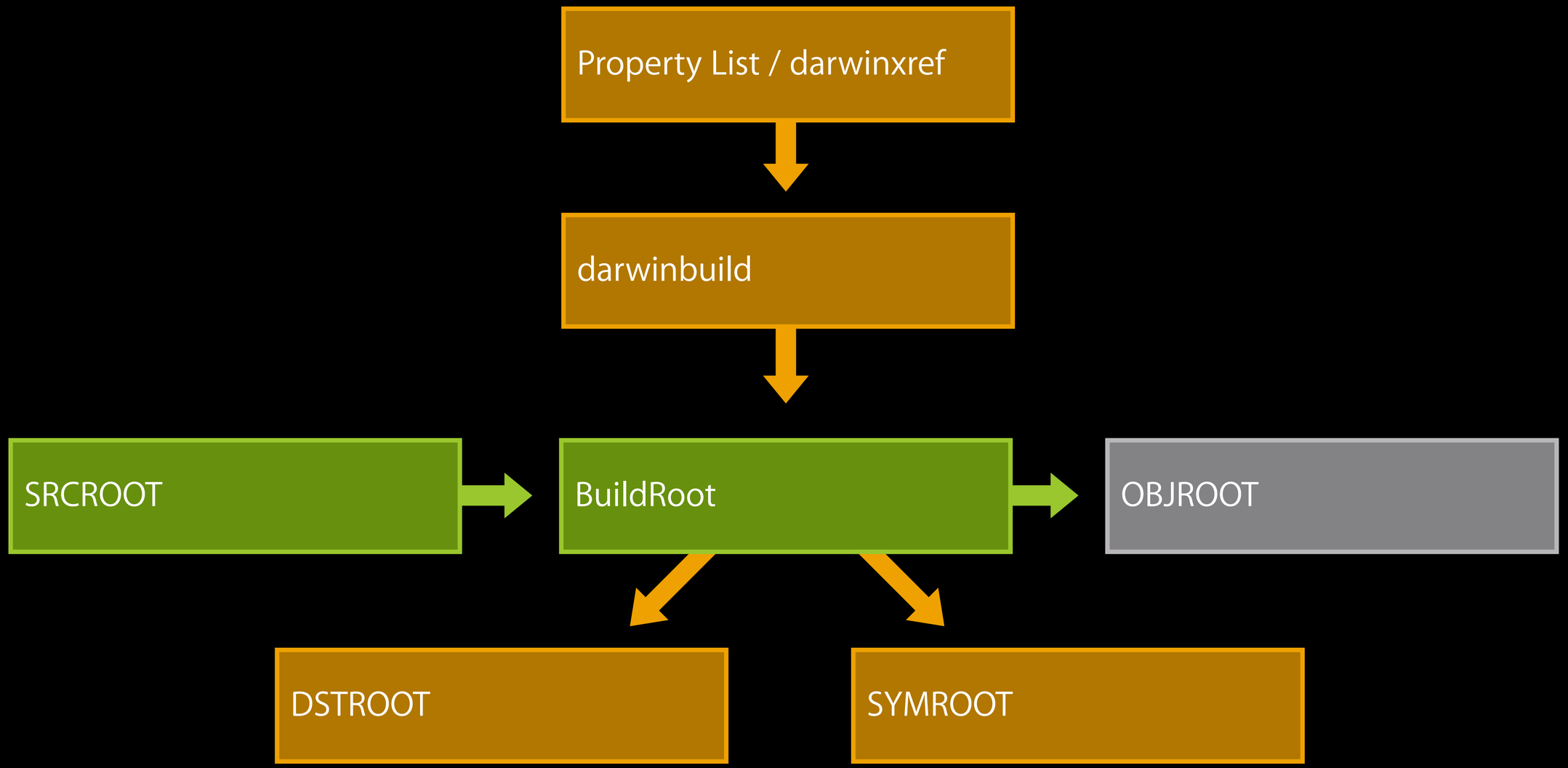

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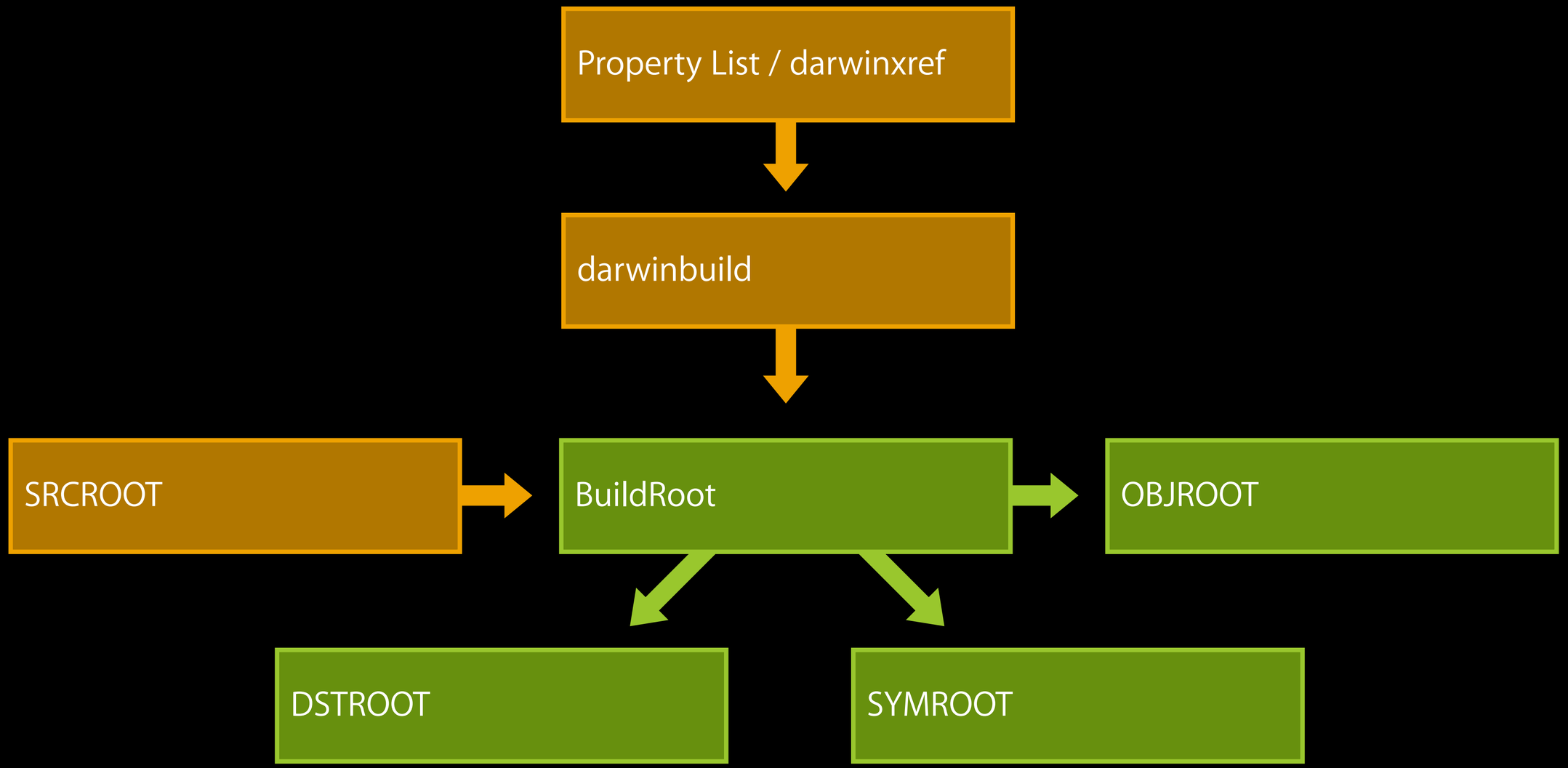

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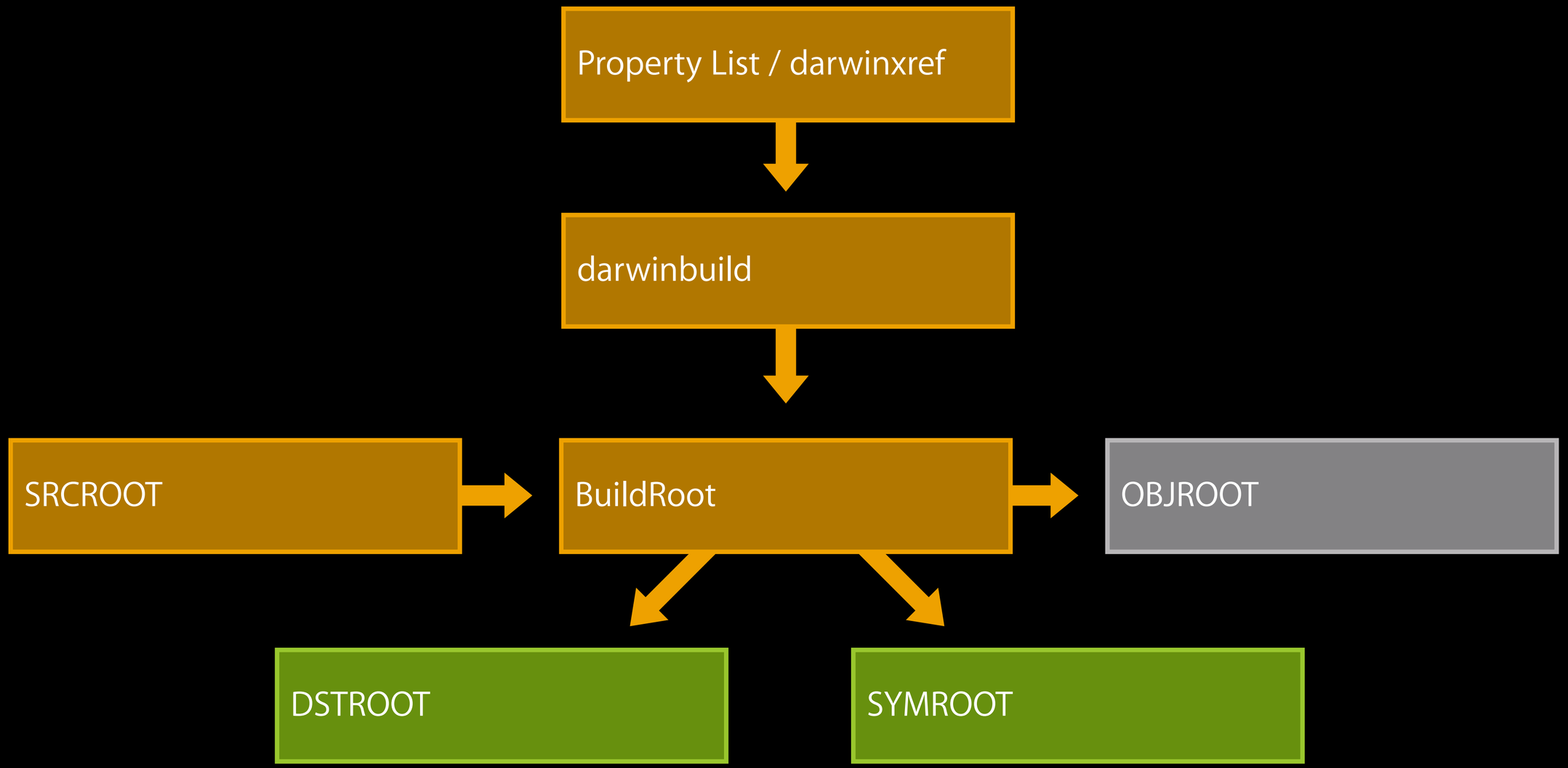

Hands-On

http://developer.apple.com/wwdc2005/

Overview

Add Bonjour support to the BSD UNIX talk utility

- Modify `talk` to browse Bonjour registrations
  - Use pluggable authentication module (PAM) to register with Bonjour
- Build `talk` with DarwinBuild
- Build `ncurses` with DarwinBuild
- Debug and run `talk` and `ncurses`

Installation

```
$ cd /tmp
$ tar xzvf ~/Desktop/WWDC_508_SampleCode.tar.gz
$ cd WWDC_508_SampleCode
$ sudo -s
# bin/darwinxref loadIndex plists/8A428.plist
# bin/darwinxref loadFiles plists/files-8A428.txt
# bin/darwinxref loadIndex plists/WWDC.plist
```

Modifying the Sources

```
# bin/darwinxref -b 8A428 findFile talk
# cd Sources
# tar xzvf network_cmds-245.tar.gz
# patch -p0 < network_cmds-245.diff
# cd ..
```

Building the Sources

```
# bin/darwinbuild -build=WWDC -chroot network_cmds
# bin/darwinbuild -build=WWDC -chroot ncurses
```

Debugging

```
# ln -s /tmp/WWDC_508_SampleCode/BuildRoot/SourceCache   /

# gdb Symbols/network_cmds/network_cmds-245.sym~1/talk

(gdb) set environment DYLD_LIBRARY_PATH= /tmp/
WWDC_508_SampleCode/Symbols/ncurses/ncurses-15.sym~1/usr/
lib/lib/

(gdb) b main
(gdb) b initscr
(gdb) r --list
...
(gdb) quit
```

Installing PAM module

```
# cp Roots/network_cmds/network_cmds-245.root~1/usr/lib/
pam/pam_mdnsregister.so     /usr/lib/pam/

# cp /etc/pam.d/login /etc/pam.d/login.orig

# echo "session optional pam_mdnsregister.so" >> /etc/
pam.d/login

# login

$ dns-sd -B _ntalk._tcp local.
```

Installing Talk

```
# cp /usr/bin/talk /usr/bin/talk.orig

# cp Roots/network_cmds/network_cmds-245.root~1/usr/bin/
talk  /usr/bin/

# launchctl load -w /System/Library/LaunchDaemons/
ntalk.plist
```

More Information

http://developer.apple.com/wwdc2005/

Documentation, Sample Code, and Other Resources

http://developer.apple.com/wwdc2005/

Who to Contact

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Q&A

http://developer.apple.com/wwdc2005/

WWDC2005

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